CANDIDATE CENTRAL REGION SCIENCE PRIORITY: INTEGRATED SCIENCE TO SUPPORT LANDSCAPE MANAGEMENT

INTRODUCTION

The goal of this document is to advocate designation of Integrated Science to Support to Landscape Management as a Central Region priority. Identifying this broad research arena as a priority emphasis would strengthen the Central Region's role in addressing the six science themes (discussed below) identified during the October 2003 PC-REX meeting. By highlighting integrated science to support landscape management at the Regional level, we could help in identifying priority issues of the Federal Land Management Agencies (FLMAs); allow us to find geographic areas of overlap of similar interagency issues, and; bring the resources to those issues by partnering with USGS programs, regional management, and field centers. This document addresses the overarching need of such a regional focus and lists areas of potential program growth. General areas of potential research activities that address the needs of the FLMAs are given, as are two potential areas that could enhance the Central Region leadership role by fostering applications of integrated science useful to DOI land management agencies, the US Forest Service (USFS), and US Environmental Protection Agency (EPA). Detailed project-level actions will be developed subsequent to a decision to proceed.

ISSUE

The USGS has a successful history of supporting FLMAs by applying sound and objective science to complex water, biological, and natural-resources issues faced by Federal and Indian land managers. Science for landscape management is a core mission of the USGS—it is what we do. Our science directly impacts the stated DOI strategic mission areas of resource protection, resource use, and serving communities. Each USGS discipline currently focuses considerable fiscal and human resources on such research arenas as locating and estimating natural resource endowments and determining the environmental consequences of develop; studies to identify and help manage threatened and endangered species; landscape change, and; water quality and quantity issues.

The Central Region fiscally supports integrated science through the Science on the DOI Landscapes and CRISP funding processes. The Science for DOI Landscapes funds are focused primarily on projects for the Bureau of Land Management scheduled to extend through FY07. The Central Regional Director's office and the Science Associates Team play an important role in helping to foster integrated science efforts and leverage program funding at the regional level. As well, several USGS Programs have been vital supporters by funding integrated science projects. The power of an integrative and collaborative management approach is being realized in a few important cases (for example, the Mancos Shale project and several abandoned mined lands projects). These successes have a common root in having interdisciplinary participation across the Central Region in which the program coordinators came together with the field center staff and regional managers to build collaborative science programs to meet the needs of the FLMAs.

Establishing Integrated Science to Support Landscape Management as a Central Region priority will yield a coherent tactical mechanism to address the science needs of the FLMAs throughout the region. The objective is to focus collaborative planning with USGS program coordinators and scientists and managers from the field centers and Central Region to develop robust integrated science to meet the needs of the FLMAs. The Science on the DOI Landscape funding will provide the backbone for the Regional component of this effort. Successes generated will be used to help justify an increase in FY06 of the DOI Landscape Initiative. The collaborative planning approach is time intensive—takes dedication and consistency to build a common vision. By codifying this as a Central Region priority, we will provide a long-term management framework and a stable funding source for working with the stakeholder agencies.

STAKEHOLDERS AND ISSUES

A central issue facing FLMAs and the USGS is effective communication. The underlying goal of a coordinated effort highlighted here is to foster intra- and interagency communication to help prioritize and coordinate the science needs with the USGS capabilities and funding constraints. Below are listed a few high-level issues for DOI agencies, USFS, and the EPA, who would directly benefit from a focused regional effort on integrated science for landscape management.

Cross-cutting science needs identified from the DOI agencies in the October 2003 PC-REX meeting also include those needs from the USFS, EPA, and other agencies.
These include:

1) energy and mineral resource extraction
2) restoration of ecosystems
3) invasive species
4) managing natural systems in the face of variability
5) water quality, quantity, and availability
6) rapid response

Energy and Mineral Resource Extraction: The BLM, USFS, and EPA have critical needs for data and interpretations on energy and mineral resource-forming processes, resource location, economic estimates of their endowment, and studies on the environmental consequences of their extraction. *One outgrowth of a regional Integrated Science to Support Landscape Management priority could be to help coordinate these efforts across the disciplines where practical, thus fostering interdisciplinary research to meet the needs of the partner agencies.*

One outgrowth from the PC-REX meeting was the formation of a DOI Mineral-Energy Coordinating Committee charged with identifying critical priorities for science needs and aligning them with realistic expectations of the support the USGS can provide. *A follow-up action should be inclusion of the Regional Science Coordinators and Science Associates (as necessary) to the committee. This will facilitate communication across the Region to bring resources to the geographic areas of mutual interest.*

Restoration of Ecosystems: The science needs prioritized at the PC-REX meeting include studies on the scientific and cost feasibilities related to ecosystem restoration; the range of variability in natural processes in areas requiring restoration; the original state of the system and its evolution; and the component parts, relationships, and the dynamic nature of the ecosystem. Collaborative restoration efforts identified relevant to the Central Region might include: sagebrush-steppe ecosystems (Wyoming); abandoned mine lands (Colorado, Montana, New Mexico); urban interface (region-wide); the Northern Gulf of Mexico (Louisiana, Texas). *The USGS can bring an integrated science approach to address these issues.*

Invasive Species: The invasive species issue is currently a regional priority and future action plans are discussed in an accompanying document.

Managing Natural Systems in the Face of Variability: The PC-REX meeting identified modeling and forecasting national and local effects of land management decisions with the goal of identifying needs for DOI level monitoring and modeling activity as one unifying need for the FLMAs. Information needs include geologic, biologic, and hydrologic data, summary and synthesis of scientific information, and training for land managers.

Drought is one area of potential program development for the Central Region that addresses the issue of managing natural systems in the face of variability. *The scientists within Central Region are leaders in the fields of climate change and predicting the human controls and impacts on drought prediction and associated flooding—this is an area of strength we can build upon. A coordinated effort by Central Region scientists could yield integrated models that could address the needs of the FLMAs.*

Water Quality, Quantity, And Availability: Water availability is currently a regional priority and future action plans are discussed in an accompanying document.

Rapid Response: The rapid response issue is being addressed in a pilot activity led by the Central Region to address the short-term science needs of our FLMA partners.

OPPORTUNITIES FOR INTEGRATION

There are several potential areas of research that can directly benefit our stakeholder land- management agencies. Below are just a few topics that go beyond current activities sponsored during FY04 by the Central Region.

Forecasting Landscape Change

Landscape change is caused by natural and human processes and affects all systems on the Earth's surface. Landscape change may be caused by natural processes such as earthquakes, floods, storms, droughts, or wildfires. Human processes, such as agriculture, road building, dam and levee building, or urbanization also cause landscape change. These processes, whether caused by natural or human agents, have immense

consequences on the Earth's surface; for example, landscape change is thought to be one of the prime drivers of global climate change. Landscapes respond to these drivers in ways that range from subtle, slow changes in habitat and populations to catastrophic collapse of waterways and ecosystems. The ability to forecast landscape change and the responses to these changes of natural and human systems that depend on these landscapes would provide new tools to improve land-management decisions such as balancing competing needs for land use. In order to implement scientifically based landscape change forecasts, it is necessary to develop a landscape change monitoring system to provide data to run and validate the forecasting models. *Opportunities for integrated science in landscape change include studies on urban dynamics, changes in aquifer recharge areas related to urban growth, agricultural ecosystems, and contributions to ecosystem changes at National Park gateway communities.*

Abandoned Mine Land (AML) and Related Research: Most of the recent emphasis of USGS research on abandoned mine land issues has focused on identifying natural and anthropogenic sources of toxic metals related to hard-rock mining. The recently completed Director's AML Initiative brought together researchers from all disciplines to focus on two watersheds in the Central Region: the Animas River, CO and the Boulder River, MT. These hallmark efforts have generated numerous integrated studies that apply cutting-edge research directly to the land managers' on-the-ground-issues by trying to address the source of metals within a given watershed and the effects of potential mitigation efforts on the success of removing metals from the ecosystems. These efforts have direct ties to BLM, UFS, and EPA activities. *However, AML issues also occur in areas affected by coal mining throughout the Central Region. AML research related to coal extraction may be an area of potential program and funding development that needs to be explored.*

USGS PROGRAM GOALS

Linkages across the USGS for Integrated Science to Support Landscape Management come from the following programs:

- Contaminant Biology; Cooperative Water Program; Energy Resources; Ecosystems, Status and Trends; Geographic Analysis and Monitoring; Ground Water Resources; Invasive Species and Emerging Diseases; Land Remote Sensing; Mineral Resources; National Cooperative Geologic Mapping; National Research Program; National Water Quality Assessment; Toxic Substances Hydrology
- Future Science Directions include Ecosystem Health, Sustainability, and Land-Surface Change

STRATEGY

The USGS is an important provider and coordinator of information related to critical issues in the natural sciences. The USGS is well positioned, in terms of its information resources, technological capabilities, and range of professional expertise, to provide well-coordinated, comprehensive responses to societal needs. Interactions between the environment and its biota and people are highly complex and unpredictable; solutions will require integrative, multidisciplinary approaches. The National Research Council,

Committee on Future Roles, Challenges, and Opportunities for the USGS (2001) noted that the USGS should place more emphasis on multi-scale, multidisciplinary, integrative projects that address priorities of a national- as well as regional-scale. The committee recognizes that science integration is difficult to achieve, especially in cases that require integration of natural and social sciences. However, failure to integrate inhibits the understanding of many natural-science problems.

Identifying "Integrated Science to Support Landscape Management as a Regional priority would provide an overarching framework to better communicate and manage all landscape-related science activities and initiatives. The Central Region is currently supporting two projects through the Science on the DOI Landscape initiative (Coalbed Methane and Mancos Shale Landscapes). Both are integrated science activities that are addressing landscape effects of management activities. Other CRISP activities also could be linked to such an umbrella framework, and this organization could be used to implement and support increases to budget initiatives.

Next Steps – Budget Cycle Objectives
FY2004

1) Decide if Integrated Science to Support Landscape Management is a regional priority and who will be the coordinating team. It is recommended that if this issue is identified as a regional priority, the Central Region Science Associates, along with a REX as a champion, and senior scientists as appropriate, be tasked with carrying out the activity. After these steps are taken, more detail plans for science applications can be developed.
2) Prepare for and convene a workshop with the Central Region USGS leadership and the BLM State Director's workshop in April 2004 as called for in the recent USGS-BLM Memorandum of Understanding that would follow upon a meeting between the Regional Directors and BLM senior management.
3) Convene a workshop involving the local and state BLM land managers and USGS management and scientific staff to prioritize science needs and practical approaches related to issues surrounding the Powder River coalbed methane development.
4) Help organize a field trip during spring or summer to the Mancos Shale Landscapes project area in the Gunnison Gorge National Conservation Area. Field trip participants should include project scientists, BLM scientists and managers, and USGS managers (including appropriate Program Coordinators).
5) Establish and prioritize the "Rapid Response" activities based on the 10 percent of the Science on the DOI Landscapes funds.

FY2005

1) Continue to provide leadership support for the Science for DOI Landscapes projects (Mancos Shale and Powder River coalbed methane)
2) Develop detailed plans and launch new projects through the CRISP funding process that bolster the integrated science approach to collaborative science in support of the FLMAs.
3) Evaluate and adjust the "Rapid Response" process as necessary.

FY2006
Work to increase the Science for DOI Landscapes initiative by using new examples of collaborative management approaches to science application.

CLOSING COMMENTS
Highlighted above are several opportunities for collaborative and integrated science, which in aggregate far exceed the fiscal resources of the USGS. Priorities have to be established such that sufficient resources are mobilized to adequately address the science needs of our FLMA partners. Prioritization of the potential integrated science projects to be done in an informed and realistic manner. Elevating Integrated Science to Support Landscape Management to a regional priority will help that prioritization process.